Space Weather Technical Forecast

Issued on Wednesday, 21 September 2022 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-flares (R1-R2 Radio Blackout). G1/Minor or G2/Moderate Geomagnetic Storm intervals likely late day 2 (22nd) or day 3 (23rd). Active Electron Fluence following later day 4 (24th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate over the past 24 hours, with an M1.1 flare from AR3105 at 20/0702 UTC, and a number of C-flares also observed. There are five sunspot regions on the solar disc. AR3102 Esi/Beta has seen some decline of its intermediate spots and remains in a relatively simple magnetic configuration. AR3105 Dki/Beta is the largest group on the disc, this region produced the most recent M-class flare. The other region of interest is a new region close to the southeast limb, it has been numbered AR3107 and analysed as an Hsx/Alpha, but it has the potential to develop into a significant group as it comes more into view. Two other numbered groups on the disk are weak and stable. No Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind , as measured by DSCOVR and ACE at L1, has generally persisted at slightly elevated levels, with speeds varying between 450-520 km/s, perhaps due to ongoing influence of the fast wind of CH23/-. Density was mostly at average levels. The total interplanetary magnetic field (IMF), Bt has been largely Weak, between 4-6nT. The north-south component Bz, fluctuated between -5 nT and +5 nT. The phi angle remained predominantly negative (towards the Sun), though did rotate into a positive (away from the Sun) sector after 21/0900 UTC. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, eased to be close to background levels. High energy electron flux (greater than 2 MeV) was at background to Moderate, with peak value 409 pfu at 20/2110 UTC. The associated 24 hour fluence remained well below the Active (1e8 integrated pfu) threshold. Observed fluence at 21/0000 UTC was 7.31e6 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low to Moderate with further C-flares and a chance of M-flares. The main M-flare risk is transferring to AR3105, although the new region AR3107 will need monitoring as it rotates onto the disc.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Slightly elevated solar winds are expected to gradually ease towards background, with the next enhancement, from the fast wind of CH25/+ expected either late day 2 (22nd) or day 3 (23rd). Geomagnetic activity is expected to be generally Quiet with isolated Unsettled spells until later day 2. There is the potential for activity to increase to Active to G1/Minor Storms, with a chance for G2/Moderate Storm intervals either late on day 2, or day 3 (22nd or 23rd). Conditions then easing to Quiet to Unsettled, with isolated Active spells through day 4 (24th).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES-16, is expected to continue to fall to background levels. The high energy electron flux (greater than 2 MeV) is expected to persist at Background to Moderate, before rising in response to fast wind arrival from CH25/+. This likely rising to High levels on day 4 (24th) The associated 24-hr fluence is expected to stay below the Active (1e8 integrated pfu) threshold for much of the period, but likely rising above by the end of day 4 (24th).

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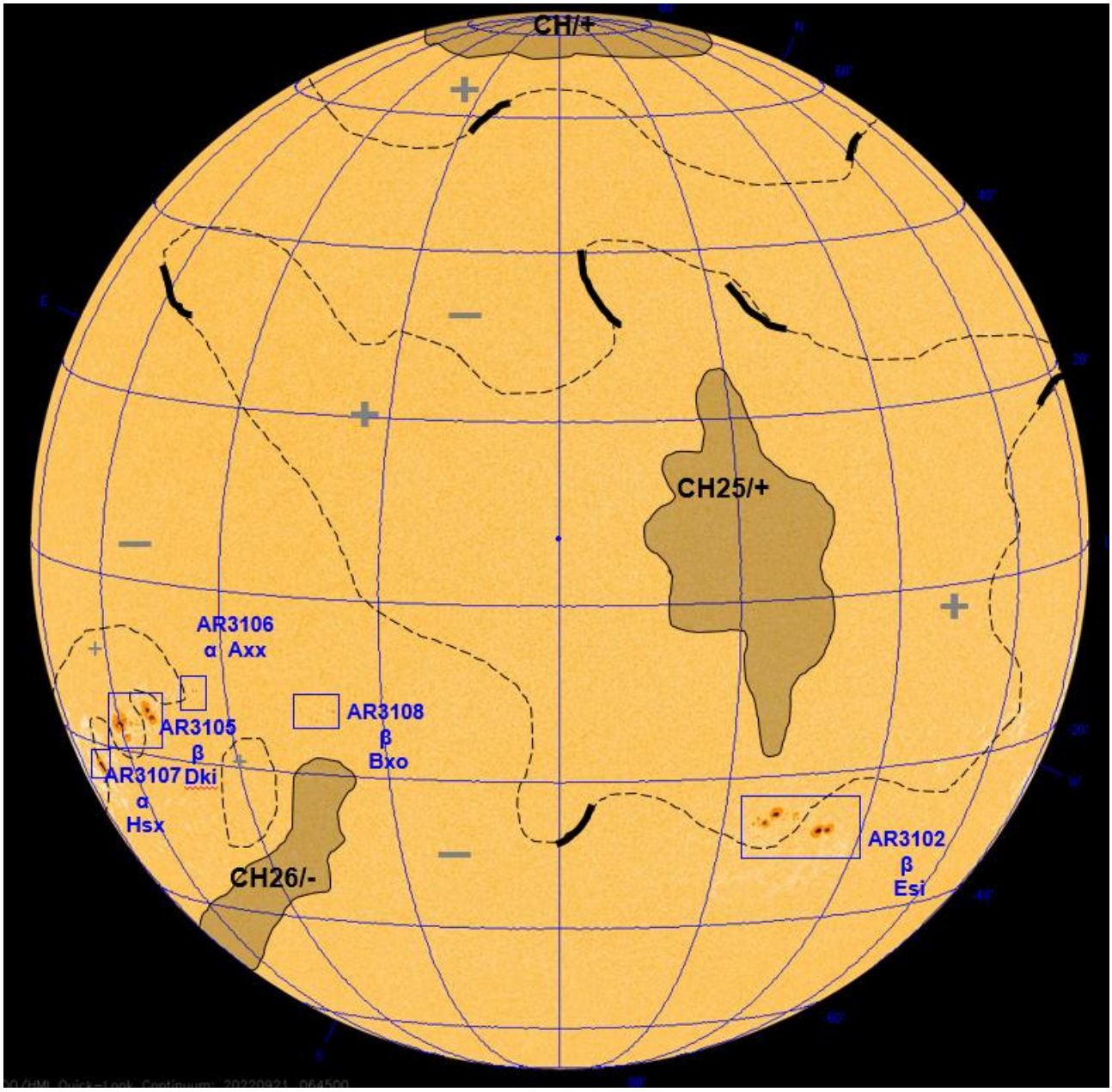
Figure 1. Solar Analysis Valid 21/0700 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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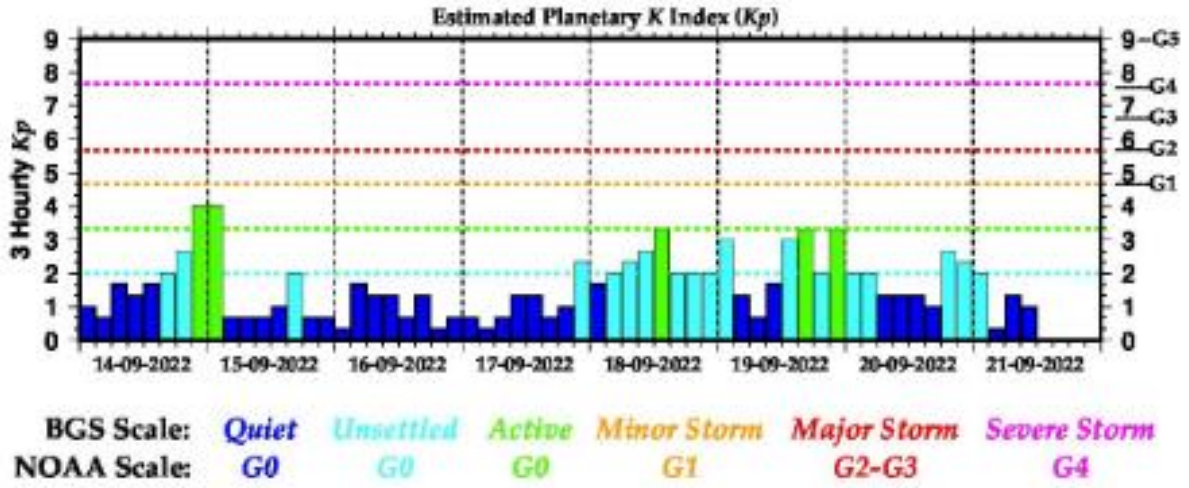
Geomagnetic Storms:

No Earth-directed CMEs have been observed.
Earth continues to exit the influence of negative polarity CH23, with the current slightly elevated solar winds likely easing to background through day 1 and 2 (21st and 22nd). There is then the potential for further strong enhancement either later on day 2 (22nd), or on day 3 (23rd) from the arrival of fast wind from CH25/+. This is uncertain however, due to this feature being much larger and more distinct than on the previous rotation, STEREO A only sampling solar wind conditions around 1.5 days ahead of Earth, and also Enlil currently suggesting a later, and weaker arrival. However, due to its positive polarity, this is favoured for connection around the autumn equinox (Russel-McPherron effect), giving a chance of a notable response from any fast wind arrival or CIR region that precedes it.
Geomagnetic activity is expected to be generally Quiet with isolated Unsettled spells until later day 2. There is the potential for activity to increase to Active to G1/Minor Storms, with a chance for G2/Moderate Storm intervals either late on day 2, or day 3 (22nd or 23rd). Conditions then easing to Quiet to Unsettled, with isolated Active spells through day 4 (24th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	40	60	20
Strong	G3	No	1	5	5	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Kp index



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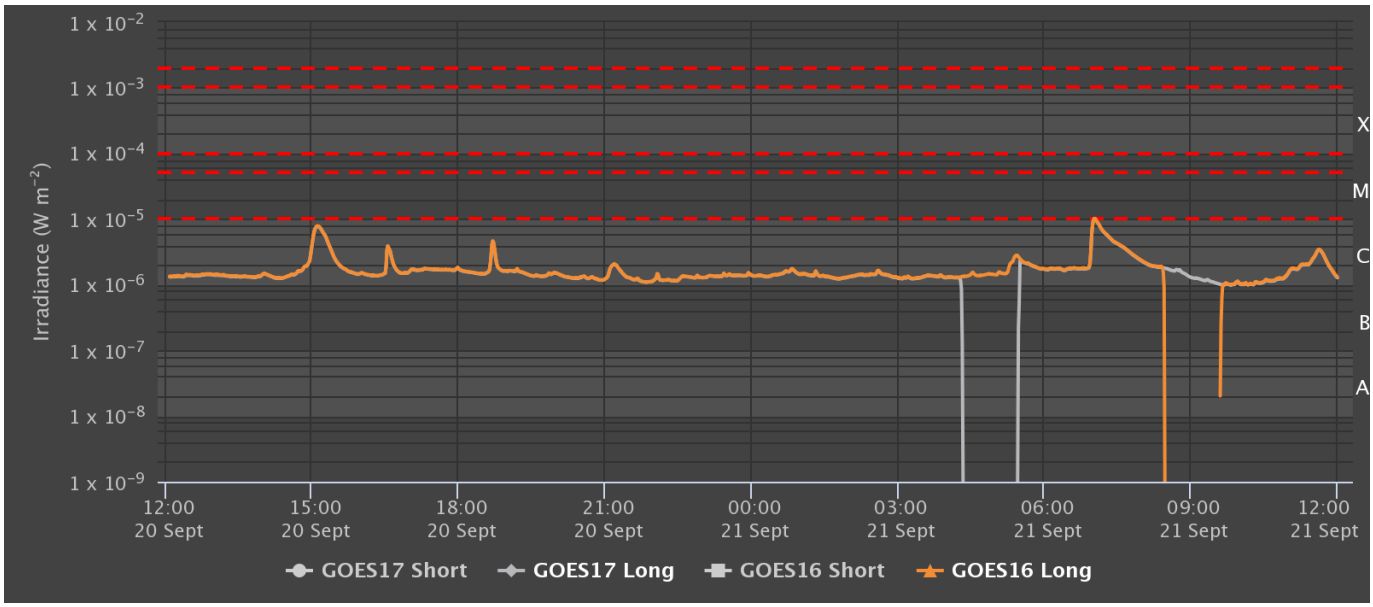
Radio Blackouts - X-Ray Flares:
Solar activity is forecast to be Low to Moderate, with ongoing C-flares and a chance of further M-flares.
There are five numbered sunspot regions on the Earth-facing disc. AR3102 Esi/Beta in the southwest has seen some decay in its intermediate spots. The largest region is now AR3105 Dki/Beta in the southeast disc. A further new region, AR3107, is becoming apparent as it rotates into view, this region appears to have the potential to develop into a significant flare risk. The other two regions, AR3106 Axx/alpha in the southeast and AR3106 Bxo/Beta to the northwest of AR3105, are both small and simple
The main flare risk is now from the regions in the southeast of the visible disk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: GOES17/17 X-Ray flares



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) observed by GOES-16 has drifted back close to background levels.

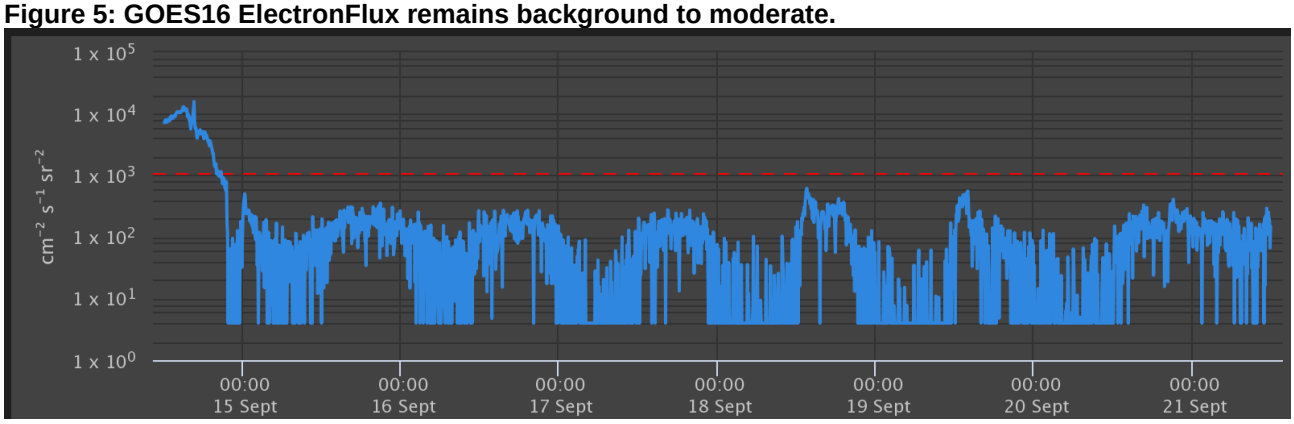
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as observed by GOES-16, is currently Background to Moderate with only a muted response from the recent fast wind from CH23/-. The arrival of the fast wind of CH25/- later day 2 (22nd) or day 3 (23rd) is likely to result in a stronger geomagnetic response, and subsequently High flux is likely to develop day 4 (24th).
The associated 24 hour fluence is expected to remain below the Active (greater than 1e8 integrated pfu) threshold until day 4 (24th), with REFM giving a good guide to current conditions and trends until at least day 3 (23rd). However the expected fast wind arrival is likely to be stronger than persistence suggests, limiting the models performance beyond this date.
Increasing flux later day 3 (23rd) and during day 4 (24th) is likely to bring Active fluence by the end of the period,

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	2

Figure 5: GOES16 ElectronFlux remains background to moderate.



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